

Concepts for Managing DoD Materiel Reliability



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GOVERNMENT CONSULTING

THE OPPORTUNITY TO MAKE A DIFFERENCE HAS NEVER BEEN GREATER

Purpose

Identify:

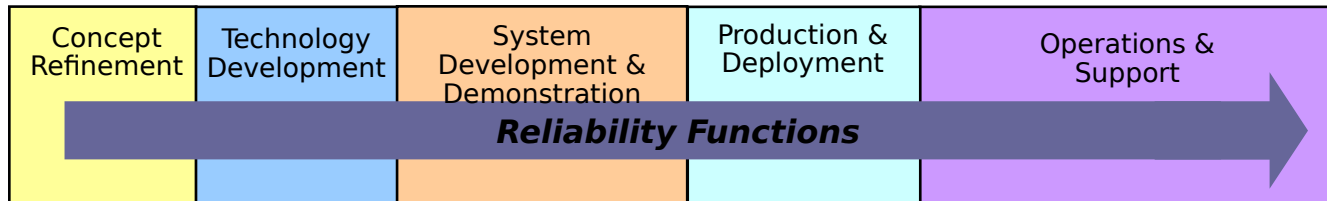
- Reliability functions or activities
- Role of maintenance in reliability
- Concepts for managing reliability



Agenda

- Reliability functions
- Role of maintenance
- Steps to effective reliability management
- Summary

Reliability – The Big Picture



Reliable & Cost-Effective Systems

- Foundational elements support effective reliability for all systems
- Enablers enhance the efficiency and effectiveness of reliability processes
- Reliability functions occur in each phase of a system's life
- Some functions are unique to a phase while others are cross-cutting
- Examples of cross-cutting reliability functions include
 - Reliability data collection, analysis, modeling, and optimization
 - Quality and Product Assurance/ Acceptance
 - Warranty strategy and management
 - Reliability Centered Maintenance
 - Reliability training



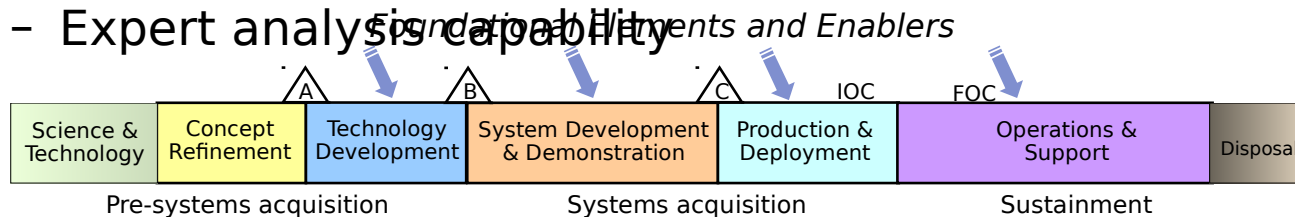
Key functional players

- Design and development engineers
- Production and quality assurance personnel
- Test and evaluation personnel
- Supply chain and item managers
- Sustaining (in-service) engineers
- Field and depot maintainers



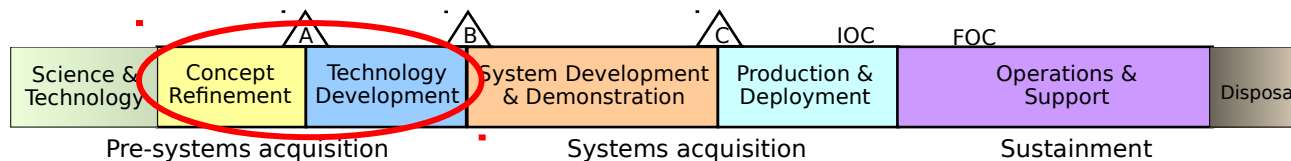
Reliability foundational elements and enablers

- Foundational Elements
 - Policy & guidance
 - Standards and specifications
 - Requirements process
- Enablers
 - Development of
 - Reliability M&S and management tools
 - Maintenance data systems
 - Warranty management systems
 - Serialized item management / item unique ID (SIM/IUID)
 - S&T for more reliable materials and systems, ISHM, and prognostics
 - Expert analysis capability



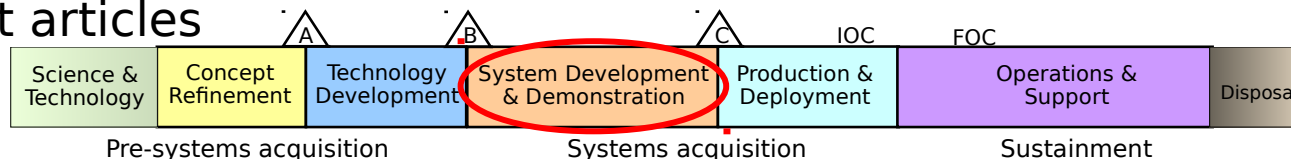
Reliability functions – Concept Refinement / Technology Development

- Concept Refinement
 - Establish reliability requirements
 - Assess concepts for feasibility to meet requirements
 - Identify functional failures
 - Select concepts that mitigate failures
 - Reliability prediction and modeling
- Technology Development
 - Requirements flow-down
 - Develop reliability performance measures, data collection and analysis
 - Develop and mature reliability models
 - Conduct tradeoff analysis
 - Establish confidence levels for meeting reliability objectives
 - Conduct reliability demos and tests
 - Ensure adequate technology maturity levels for all aspects of the system
 - Establish the warranty strategy



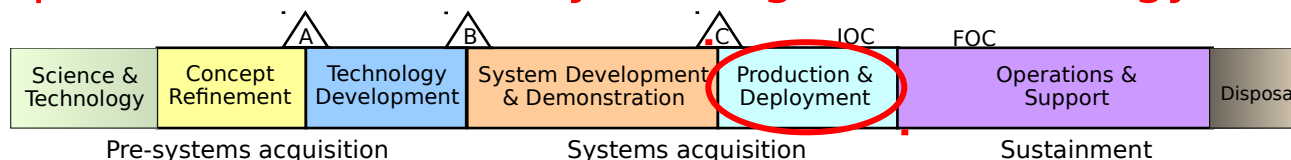
Reliability functions – System Development and Demonstration

- Develop detailed system specifications for reliability
- Model sustainment and reliability to optimize the sustainment design
- Design for reliability
 - Simplicity of design
 - Design margins & factors of safety
 - Design for ease of manufacture
 - **Design for maintainability**
 - Thorough engineering analysis
- Independent reviews
- QA/PA of drawings, specs, and test articles
- Reliability related DT&E, V&V
- Conduct analysis to identify and mitigate failures (HA, FTA, DTA, FMECA, FRACAS)
- **Maintenance plan developed - assisted by Reliability Centered Maintenance (RCM) analysis**
- **Develop the warranty management system (per strategy)**
- **Develop tools and plans for in-service reliability data collection and analysis**



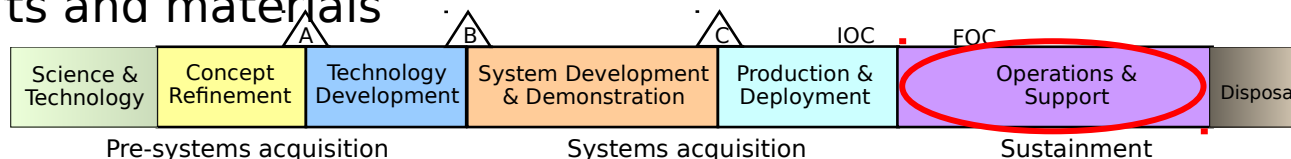
Reliability functions – Production and Deployment

- Ensure production materials meet quality standards
- Minimize product variability
- CPI for production (Lean, Six Sigma, Theory of Constraints)
- Conduct production acceptance tests
- Conduct reliability related IOT&E
- In-service data is collected, analyzed, and fed back to production
- Model and assess reliability performance to plan
- Transition to product sustainment
- Implement in-service roles, responsibilities, and training for reliability
- Implement the warranty management strategy



Reliability functions – Operations & Support

- Reliability data collection and analysis
 - Failure ID and recording
 - Analyze trends and root causes
- Reliability performance measures, reporting, modeling, and optimization
- Warranty management
- CBM+ and RCM
- CPI for maint, supply, & distribution
- QA program for maintenance
- Product acceptance / procurement of reliable supply parts and materials
- Train sustainment personnel on approved processes and reliability
- Identify approaches for reliability improvement
- Manage and update the materials, processes, and specs for maintenance
- Update DTA, HA, FTA, FMECA, and other failure analyses
- System life assessments and in-service reviews
- Service Life Extension Programs



Agenda

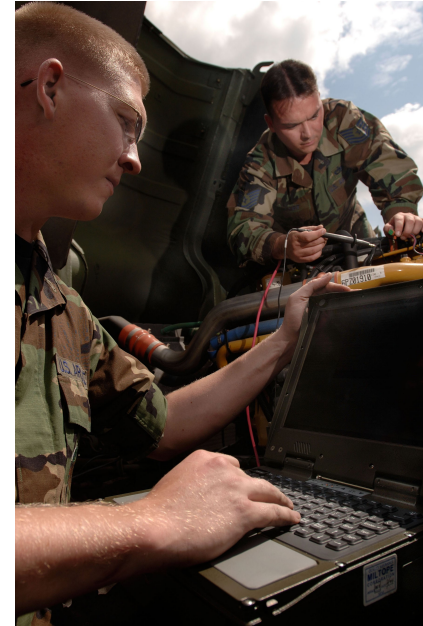
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- **Role of maintenance**
- Steps to effective reliability management
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Role of maintenance in reliability

“Tip of the spear” for observing

Primary Roles failures

- Prevent
 - Support the updating of maintenance processes
 - Conduct preventive and predictive maintenance
 - Communicate with operators and engineers
- Restore
 - Diagnose failure
 - Take appropriate action on deficient items
 - Quality Assurance for maintenance
- Report
 - Failure ID & categorization
 - Record failure and maintenance data
 - Initiate deficiency reports/warranty actions
- Requires
 - Trained and skilled maintainers
 - Interface with engineering & supply



Prevent

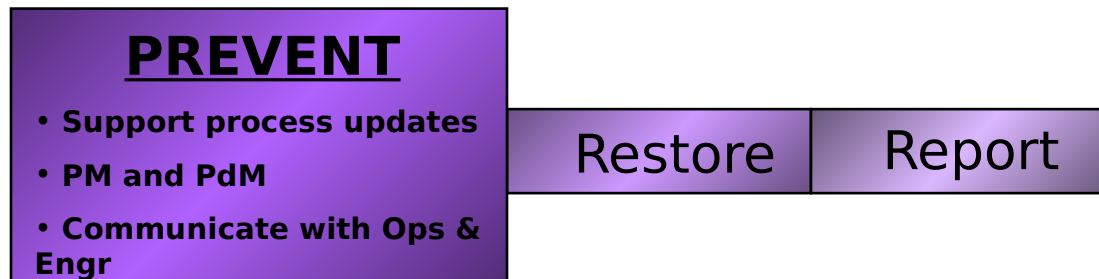
Restore

Report

Role of maintenance

Prevent failures

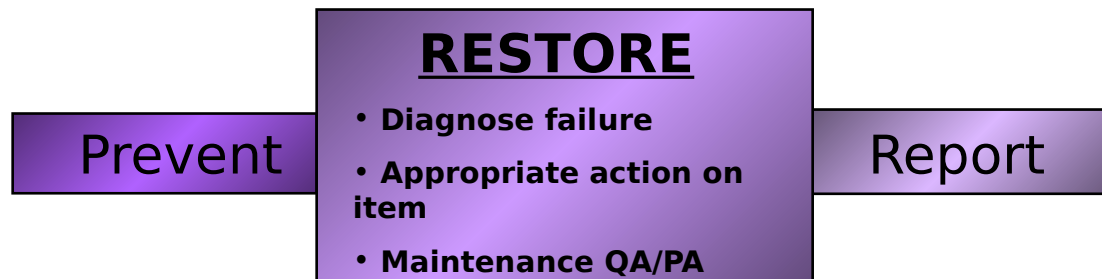
- Support the updating of maintenance processes and schedules
 - Support engineers as they periodically update maintenance processes and schedules based on RCM analysis
 - Work with engineers, as requested, to assess impact of operational changes or environmental influences
- Conduct Preventive and Predictive Maintenance
 - Maintain the embedded health management capabilities
 - Conduct PM and PdM tasks as planned to reduce total maintenance
- Communicate with operators and engineers
 - Establish dialogue with operators and engineers to “eliminate” failures
 - Ensure operators and engineers understand the current reliability state



Role of maintenance

Restore failed items

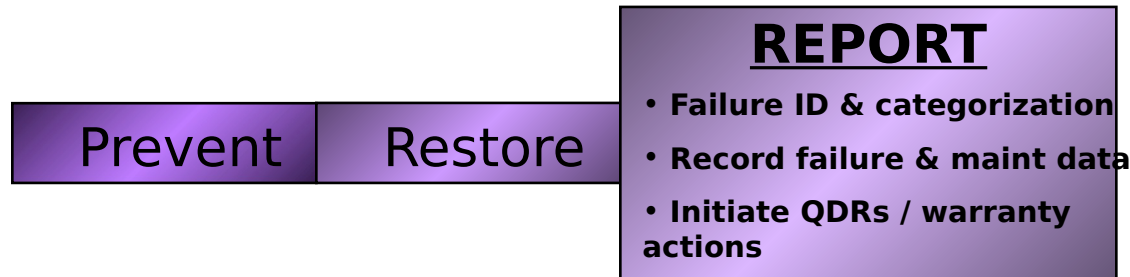
- Diagnose failure
 - Locate & isolate failed items
 - Skilled maintainers use approved troubleshooting equipment and procedures
- Take appropriate action on deficient items
 - Skilled maintainers use approved maintenance equipment, materials and procedures
 - Reduce repeat failures (Is item under warranty? Is it a bad actor?)
- QA/PA for maintenance processes and materials
 - Ensure maintainers use qualified materials and processes
 - Establish a Quality Assurance program for maintenance
 - Analyze quality “escapes” and no fault found events for trends and corrective actions



Role of maintenance

Report failure and maintenance actions

- Failure identification and categorization
 - Identify conditions under which failure occurred
 - Categorize type and cause of failure
- Record failure and maintenance data
 - Record failure type, description, location, part & serial #
 - Record maintenance action(s), description(s), technician(s)
 - Requires user friendly data system which everyone employs
 - Automation with SIM/IUID will greatly improve data collection
- Initiate quality/materiel deficiency reports, bad actor and warranty actions
 - Assess if item requires QDR, bad actor, or warranty action
 - Follow approved procedures and communicate with engineering and supply



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Researching the steps








- Reviewed articles, conference proceedings, and white papers on commercial approaches
 - Examined documents for prominent and consistent themes
 - Identified “best practices” and the common approach for organizational change
- Assessed best practices and approach for applicability to the DoD






Commercial industry

Best practices for reliability

- Proactive maintenance that emphasizes a culture of *reliability* as opposed to *repair* 
- Partnership between maintenance and operations 
- Benchmarking 
- Involved training that instills an internalized sense of purpose 
- Proper usage of and training in a computerized maintenance management system (CMMS) 



Commercial Industry Approach to reliability transformation

- Plan 
 - Create a vision and assess current status
 - Conduct gap analysis and develop strategy for closing gaps
 - Develop business case and project plans
- Implement 
 - Review the reward system
 - Communicate, educate, and change the culture
 - Set up management processes and teams
 - Establish and employ indicators and metrics
- Sustain 
 - Integrate with existing business processes
 - Sustain the change in culture



Application to the DoD

- Commercial “best practices” and approach to transformation have direct application to the DoD
 - Principles apply in any operating space
 - DoD already has a “leg up” on some best practices (e.g. CMMS, training, and benchmarking)
 - DoD structure and discipline should facilitate the three step approach of *plan, implement, and sustain*
- Key distinctions:
 - Number and breadth of key players
 - Multiple organizations and cultures
 - Different leadership-subordinate relationship
 - Cradle to grave stewardship
 - Operates in public sector (business case is not based on profit)



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Summary

- Reliability functions in the DoD involve numerous activities across various functional areas
- As the first observer of failures, maintenance plays a key role - *prevent, restore, and report*
- The DoD can learn from “top-performing” commercial industry approaches and practices
- The DoD should establish a vision for reliability excellence in sustainment

